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10 August 1978

MEMORANDUM FOR: Mr. Jeremiah Kratz
Division of International
Security Affairs
Department of Energy

SUBJECT : Soviet Production of Multi-
Axis Contouring Machine Tools

Attached, per your request, is a discussion of Soviet production of multi-axis NC machine tools. Additional information on individual models of 3, 4, and 5-axis machine tools is presented in two tables for your convenience. Table 1 identifies models of multi-axis NC machine tools and estimates of output; Table 2 provides technical data on individual models. If you have further questions on the subject, please contact [redacted]
[redacted]

[redacted]
Office of Economic Research

Attachments:
as stated

[redacted]
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ATTACHMENT

Status of NC Machine Tools
in the USSR

The USSR began small-scale serial production of 3-axis contouring machine tools and control units in 1972 (see Table 1). The transistorized control units available at that time were open-looped and incapable of circular interpolation.

By mid-1974, a small number of a new generation of 3-axis hardwired NC units were being mated to machine tools. These units, now readily available, use small-scale integration and represent current Soviet state-of-the-art in numerical control technology. Although the USSR is currently developing new NC devices using medium-scale integration, their serial production is not imminent. It is expected that the third generation NC units, introduced in the early and mid-1970s, will remain the Soviet mainstay at least through 1980.

Our information indicates that in 1975 the quality of Soviet NC machine tools was not high. Most were slower and

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less accurate than Western counterparts, mainly because they were equipped with stepping motors instead of low inertia motors which are typically used in Western models. The Soviets had trouble making low inertia motors because high quality permanent magnets were not available. In addition, transducers, inductosyns, and the controls proper, were all of low quality.

We doubt that there has been a significant improvement in the overall quality of Soviet NC machine tools since 1975. Most NC machine tools continue to use stepping motors, and for the same reason; low inertia motors are not available in sufficient quantities for wide useage. Moreover, numerical control units that were produced in 1975 are the same models being produced today, and these will continue to be produced at least through 1980. Almost certainly, following long-established practice, if major changes or other technological improvements in controllers had been made, they would have been reflected in the introduction of wholly new models.

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Table 1

Soviet Multi-axis NC Machine Tools: Types and Estimated Output

Model Number	Type of Machine	Manufacturer	Year Reported in Production	Estimated Production Through 1977	NC Unit	Interpolation: Linear/Circular	Control Loop: Open/Closed
Axis Contouring							
6RL3F3	Vertical Milling	Cor'kiy	1972 1975	25 50	2PT-7L/3 N332M	Linear Linear/circular	Open Closed
6RL3RF3	Vertical Milling (with turret)	Cor'kiy	1973 1974	20 50	2PT-7L/3 N331M	Linear Linear/circular	Open Open
6520F3	Vertical Milling	L'vov	1973 1974	20 50	2PT-7L/3 N331M	Linear Linear/circular	Open Open
P6520F3	Vertical Milling	L'vov	1975	25	2PT-7L/3	Linear	Open
106520F3	Vertical Milling	L'vov	1975	25	N331M	Linear/circular	Open
6520RF3	Vertical Milling (with turret)	L'vov	1975	25	N331M	Linear/circular	Open
1F270F3	Vertical Milling	L'vov	1975	25	N331M	Linear/circular	Open
1F260F3	Vertical Milling	L'vov	1975	20	N331M	Linear/circular	Open
1F260MF3	Vertical Milling	L'vov	1975	5	N331M	Linear/circular	Open
MF655MF3	Vertical Milling	Stankokonstruktsiya	1976	Less than 5	N552	Linear/circular	Closed
6305F4	Plano-miller	Cor'kiy	1977	5	N551	Linear/circular	Open

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Table 1

Soviet Multi-axis NC Machine Tools: Types and Estimated Output (continued)

<u>Model Number</u>	<u>Type of Machine</u>	<u>Manufacturer</u>	<u>Year Reported in Production</u>	<u>Estimated Production Through 1977</u>	<u>NC Unit</u>	<u>Interpolation: Linear/Circular</u>	<u>Control Loop: Open/Closed</u>
<u>-Axis Contouring</u>							
(continued)							
6B443CF3	Horizontal-Milling	Sverdlov	1977	Less than 5	N552	Linear/circular	Closed
6B444F3	Horizontal-Milling	Sverdlov	1977	Less than 5	N552	Linear/circular	Closed
6B445F3	Horizontal-Milling	Sverdlov	1977	Less than 5	N552	Linear/circular	Closed
<u>4-Axis Contouring</u>							
2623PF4	Horizontal Milling	Sverdlov	1977	Less than 5	N552	Linear/circular	Closed
<u>5-Axis Contouring</u>							
GF1860	Plano-miller	Gor'kiy	1977	Less than 5	N552	Linear/circular	Closed

Table 2

Specifications of Multi-Axis NC Machine Tools

Model Number	Table Size, mm/ Travel, mm	Main Drive, Kw	Spindle Speed, rpm	Weight, M. Tons	Accuracy, mm		Other
					Positioning	Contouring	
Y-Axis Contouring							
6R13F3	1600 x 400 longitudinal cross vertical	7.5	40-2000	5.8	+ 0.08	+ 0.1	—
6R13RF3	1600 x 400	7.5	40-2000	7.6	+ 0.08	+ 0.01	Feed, mm/min. 3-1200
6520F3	250 x 630 longitudinal cross vertical	4.0	31.5-1600	3.0	+ 0.04	+ 0.06	Feed, mm/min. 5-1200
P6520F3	250 x 630 longitudinal cross vertical	4.0	31.5-1600	2.8	+ 0.06	+ 0.1	—
106520F3	250 x 630 longitudinal cross vertical	4.0	31.5-1600	2.8	+ 0.05	+ 0.08	—
6520RF3	250 x 630 longitudinal cross vertical	8.0	31.5-1600	4.0	—	—	—

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Table 2

Specifications of Multi-Axis NC Machine Tools (continued)

Model	Table Size, mm/ Travel, mm	Main Drive, Kw	Spindle Speed, rpm	Weight, M. Tons	Accuracy, mm		Other
					Positioning	Contouring	
LF270F3	250 x 630	4.0	31.5-1600	3.0	—	—	—
	longitudinal						
	cross						
LF260MF3	vertical						
	250 x 630	8.0	31.5-1600	4.0	—	—	—
	longitudinal						
M655MF3	cross						
	vertical						
	500 x 1250	5.4	63-2000	7.5	—	+ 0.05	
6305F4	longitudinal						
	cross						
	1250 x 500	19	16-1600	15.5	—	—	Table rotation, rpm .005-3.45
6B443CF3	longitudinal						
	cross						
	1250 x 630	4.0	—	8.5	—	—	Maximum weight of part, 3000 Kg.
6B444F3	longitudinal						
	cross						
	2000 x 1000	7.5	—	19.7	—	—	Maximum weight of part, 5000 Kg.
6B445F3	longitudinal						
	cross						
	3150 x 600	15.0	—	41	—	—	—

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Table 2

Specifications of Multi-Axis NC Machine Tools (continued)

Model Number	Table Size, mm/ Travel, mm	Main Drive, kW	Spindle Speed, rpm	Weight, M. Tons	Accuracy, mm		Other
					Positioning	Contouring	
2623PF4 (continued)	1120 x 1250 or (1250 x 1600) longitudinal	15.0	5-1250	23	---	---	Maximum weight of part, 4000 Kg.
	cross						
GF1860	630 x 630 longitudinal	7.8	16-2000	17.0	---	---	Magazine, 24 tools; Rapid traverse, 4800 mm/min; accuracy of table rota- tion, 12 seconds.
	700						

Axis Contouring